

## NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

### NUTRIENT MANAGEMENT

(Acre)

CODE 590

#### DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

#### PURPOSES

- ◆ To budget and supply nutrients for plant production.
- ◆ To properly utilize manure or organic by-products as a plant nutrient source.
- ◆ To minimize agricultural non-point source pollution of surface and ground water resources.
- ◆ To maintain or improve the physical, chemical and biological condition of soil.

#### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

#### CRITERIA

##### General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable Federal, state, and local laws and regulations.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning

Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Persons who review or approve plans for nutrient management shall be certified through any certification program acceptable to NRCS within the state, as detailed in RI Supplemental Policy for certification of Conservation Planners and Nutrient Management Plan Specialists.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water. In RI, approved nutrient budget worksheets include, but are not limited to: the USDA Nutrient Management Conservation Practice Job Sheet (590), 1999, NRCS, Ft. Worth, available at a local NRCS field office.

Realistic yield goals shall be established based on soil productivity information (from NRCS-RI Field Office Technical Guide (FOTG), Section II, Soil Descriptions - Capability and Yields per Acre of Crops and Pasture), historical yield data from farm records, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the form, source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters. Plans will also specify record keeping requirements.

Erosion, runoff, and water management controls shall be installed, as needed, on fields that receive nutrients to reduce the risk of nutrient transport to surface waters.

### **Soil Sampling and Laboratory Analysis (Testing)**

Nutrient planning shall be based on current soil test results developed in accordance with the University of Massachusetts (UMass) Cooperative Extension Soil Testing Laboratory which cooperates with the University of Rhode Island. (see *Sampling Soils for Meaningful Results*, UMass Extension (CDL 00-S1); *Soil Testing*, UMass Extension Soil Testing Lab).

Current soil tests are those that are no older than three years for annual and continuous crops. For hay crop rotations, current soil tests are those taken at the end of the rotation cycle and before reseeding.

Soil samples shall be collected and prepared according to the UMass Extension Soil Testing Lab guidance or standard industry practice.

Soil test analyses shall be performed by laboratories that are accepted in one or more of the following programs:

- ◆ Land Grant University soil testing laboratories from Rhode Island, Massachusetts, and Connecticut
- ◆ The North American Proficiency Testing Program (Soil Science Society of America), or
- ◆ Private Vendor Laboratories whose procedures are accepted by the University of Rhode Island or the University of Massachusetts Soil Testing Lab (see the current list of approved laboratories maintained by RI-NRCS).

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, soil organic

matter, nitrogen, plant available phosphorus, and potassium.

### **Plant Tissue Testing**

Tissue sampling and testing, where used, shall be done in accordance with recommendations of the UMass Soil and Plant Tissue Testing Lab, or other approved laboratory.

### **Nutrient Application Rates**

Soil amendments shall be applied, as needed, to adjust soil pH to the specific range of the crop for optimum availability and utilization of nutrients

Recommended nutrient application rates shall be based on recommendations from the most current New England Cooperative Extension System crop management guides that consider current soil test results, realistic yield goals and management capabilities, and associated plant nutrient removal rates. (Guides include, but are not limited to: "Minimizing Nitrate Leaching From Turf", UMass and URI Cooperative Extension Systems - Turf Notes, Volume 2, Number 6, (NRCS TRF 1.29); "*Guidelines to Nutrient Application on Field Crops*", UMass Extension; "*New England Vegetable Management Guide*", New England Cooperative Extension System; *Table 6-6, "Animal Waste Management Field Handbook"*, Part 651, NEH 210-VI, NRCS; and "*Cropland Interpretations*", Section II FOTG, NRCS.)

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- ◆ **Nitrogen Application** - Planned nitrogen application rates shall match the recommended rates as closely as possible, within 15%±. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below. Application rates for Nitrogen shall match recommendations within 10% when fields are located within environmentally sensitive areas listed under "Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources.
- ◆ **Phosphorus Application** - Planned phosphorus application rates shall match the recommended rates as closely as possible, within 10%. When manure or

other organic by-products are a source of nutrients, see "Additional Criteria" below.

- ◆ **Potassium Application** - Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages. Avoid applying potassium at rates greater than 30%± of the recommended rate. High soil test K translates into high forage K levels.
- ◆ **Other Plant Nutrients.** The planned rates of application of other nutrients shall be consistent with recognized agronomic practice. In certain situations, with either excessive or deficient amounts of a nutrient, soil or plant tissue testing may be necessary.
- ◆ **Starter Fertilizers.** Starter fertilizers containing nitrogen, phosphorus, and/or potassium may be applied, in accordance with recommendations from soil test results and nutrient budget worksheets. When starter fertilizers are used, they shall be included in the nutrient budget.

#### **Nutrient Application Timing & Method**

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.

For nitrogen management, apply only the least practical amount at or before planting, and additional N, if needed for corn, based on results of a Pre-Sidedress Nitrogen Test (PSNT), or a reasonable estimation of need using the balance sheet approach. Other fertilizer nutrients can be applied as needed, based on a soil test, prior to planting. (See *Nitrogen Management for Crops of Massachusetts*, UMass Extension; and *New England Vegetable Management Guide*, and other New England Extension System publications.)

Nutrients shall not be applied to frozen, or snow- covered, or saturated soil if a medium or high risk for nutrient transport exists. Risk of nutrient transport shall be determined, using the RI Phosphorus Index found in RI-NRCS, Section II, Field Office Technical Guide.

Medium and High risk sites, unless modified by appropriate conservation practices, shall be restricted from winter spreading.

Application of nutrients on fields that frequently flood shall be delayed until after the time of year that flooding occurs. If Soil Test Phosphorus (P) is High, or Very High, any application of nutrients after the flooding period shall be incorporated into the soil within 48 hours. Flood risk and timing shall be based on flooding class, duration, and time of year that flooding occurs, as defined by the Soil Survey of Rhode Island. Other acceptable references include federal floodplain maps, and local flooding records.

Nutrient applications associated with irrigation systems shall be applied in accordance with NRCS conservation practice standard for IRRIGATION WATER MANAGEMENT (449).

#### **Additional Criteria Applicable to Manure or Organic By-Products as a Plant Nutrient Source**

##### **Sampling and Laboratory Analysis**

Nutrient values of manure and organic by-products (excluding sewage sludge) shall be determined prior to land application, based on laboratory analysis, or acceptable "book values" recognized by the NRCS and/or the New England Cooperative Extension System, or historic records for the operation if they accurately estimate the nutrient content of the material. Book values recognized by RI NRCS may be found in the *Agricultural Waste Management Field Handbook*, Chapter 4 - *Agricultural Waste Characteristics*

Manure testing can be done from the University of Rhode Island Testing Laboratory, or other approved labs. (See the current list of RI-NRCS approved labs maintained by NRCS.)

The application of manure or organic by-products will be in accordance with the standard for WASTE UTILIZATION (633). This includes a whole farm manure nutrient budget to determine availability of land to recycle nutrients, an application schedule based on crop growth cycles and environmental restrictions, and development of alternative uses of the manure or organic by-products if excess nutrients exist.

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## Irrigation Application of Nutrients

The application rate (in/hr) for material applied through irrigation shall not exceed the soil intake/infiltration rate (Avg. rate in RI is 2 in/hr). The total application shall not exceed the field capacity of the soil (excess application results in runoff).

## Field Risk Assessment

When animal manure or other organic by-products are applied, a field specific assessment of the potential for phosphorus transport from the field shall be completed based on the following two-tier system:

Soil Test Phosphorus (P) shall provide an initial screen of potential phosphorus build-up and environmental risk. The soil test levels and the corresponding manure (P) application rate is found in Table 1 below. If Soil Test P is High, Very High or Excessive, the RI Phosphorus Index (Table 2 below) may be used to further assess the risk of nutrient transport and aid in management decisions. (See Tables 1 and 2 below)

In such cases where phosphorus levels are high, very high, or excessive, and Table 2 (RIPI) is used, plans shall include:

- a record of the RI Phosphorus Index assessment rating for each field or sub-field;
- information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the nutrient management plan. If no conservation practices can be implemented to lower the RIPI rating, use the P application rates from Table 1 or Table 2.

## Nutrient Application Rates

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

- ♦ **Nitrogen Application** - When the nutrient plan is being implemented on a phosphorus standard (see table 1 and 2, below) manure or other organic by-products shall be

applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

- ♦ **Phosphorus Application** - When manure or other organic by-products are used, the planned rates of phosphorus application (from all sources including manure and commercial fertilizer) shall be consistent with the following guides:

### 1. Soil Test Phosphorus Level Method

*(Based on University of Massachusetts soil test analysis using the Modified Morgan method or other approved method)*

**Table 1.**

<u>Soil Test Phosphorus Level</u> LB/AC	<u>Manure Application</u> Rates
Very Low and Low	Nitrogen Based
Medium	Nitrogen Based
High - Optimum	Phosphorus Based (May apply up to 1.5 Times the P needed for Crop Removal)  Or <b>Go to TABLE 2 Use Phosphorus Index</b>
Very High	Phosphorus Based (At Crop Removal Level)  Or <b>Go to TABLE 2 Use Phosphorus Index</b>
Excessive (Mod. Morgan - >47 Lb) (Bray - >120 Lb)	(No Additional manure or fertilizer P Application)  Or <b>Go to TABLE 2 Use Phosphorus Index</b>

## 2. RI Phosphorus Index Rating Method. \*\* (Field Evaluation)

**Table 2**

**Phosphorus Index Rating      Phosphorus Application**

Low Risk 25 - 38	Nitrogen Based
Medium Risk 39 - 64	Phosphorus Based (At Crop Removal Rate)
High Risk 65 - 75	No Application of manure or fertilizer P

\*\* (Use procedures detailed in the RI Phosphorus Index in the NRCS Field Office Technical Guide - Section II - Cropland Interpretations)

A single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. (*See New England Cooperative Extension Crop Management Guides , or Part 651.06 Animal Waste Management Field Handbook; NRCS.*) When such applications are made, the application rate shall:

- not exceed the recommended nitrogen application rate during the year of application, or
- not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
- not be made on sites considered vulnerable to off-site phosphorus transport (Rating of High using RI Phosphorus Index) unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.

Planned phosphorus application rates shall match the recommended rates within 10%±.

### **Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources**

Nutrient management plans shall provide a total accounting of nutrient inputs to meet the needs of the anticipated crop yield to prevent over fertilization

on fields that may potentially affect environmentally sensitive areas, including: Wellhead Protection Areas, Public Water Supply Watersheds, Outstanding Resource Waters and High Quality Waters and Designated Shellfish Growing Areas identified by the State of Rhode Island. In areas with an identified or designated nutrient-related water quality impairment, an environmental risk assessment shall be completed to determine the potential for nitrogen and/or phosphorus transport from the field. Such assessments shall include, as a minimum, ratings from the RIPI and the Leaching Index (LI).

Fields located within environmentally sensitive areas shall apply nitrogen and phosphorus within 10% of recommended rates. Additionally, nutrient management practices such as split nitrogen application rates, pre-sidedress nitrate nitrogen testing and use of a nitrification inhibitor should be considered.

If the RI Phosphorus Index (RIPI) results meet the ranges listed in the tables below, then the corresponding response shall be applied.

<b>Nutrient Transport Index</b>	<b>Response</b>
Low	No specific constraints. See Table 1 or 2.
Medium	To reduce the risk of nutrient transport, evaluate the RIPI Field Features that can be altered by the implementation of soil and water conservation practices, and implement those practices, when possible. If no practices can be adopted, apply P at the rate according to Table 1 or 2. Conservation Practices may include changes in nutrient/manure application rate, method or timing of application, runoff and erosion control practices, crop rotation, cover crop, residue management, and conservation buffers.
High	Evaluate and Implement soil and water conservation plan; do not apply manure on frozen, snow-covered or saturated soil; and do not topdress fertilizer P after September 1. If no conservation practices can be adopted, apply manure or fertilizer P according to Table 1 or 2.

Other recognized assessment tools, may be used to make environmental risk assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the plan.

Plans developed to minimize agricultural nonpoint source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field.

### **Heavy Metals Monitoring**

When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or applicable state and local laws or regulations.

### **Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.**

Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

### **CONSIDERATIONS**

Consider induced deficiencies of nutrients due to excessive levels of other nutrients.

Consider additional practices such as Conservation Cover (327), Grassed Waterway (412), Contour Buffer Strips (332), Filter Strips (393), Irrigation Water Management (449), Riparian Forest Buffer (391), Conservation Crop Rotation (328), Cover Crop (340), and Residue Management (329A, 329B, or 344) to improve soil nutrient and water storage, infiltration, aeration, tillage, diversity of soil organisms and to protect or improve water quality.

Consider cover crops whenever possible to utilize and recycle residual nitrogen.

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the

atmosphere. Suggestions include:

- ◆ split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- ◆ using the Pre-Sidedress Nitrogen Test (PSNT) to determine nitrogen application rates,
- ◆ using slow-release nitrogen to retard conversion of organic or ammonia forms of nitrogen to nitrate-nitrogen,
- ◆ avoiding winter nutrient application for spring seeded crops,
- ◆ band applications of phosphorus near the seed row,
- ◆ applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques, and/or
- ◆ immediate incorporation of land applied manure or organic by-products,
- ◆ delaying field application of animal manure or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Consider minimum application setback distances from environmentally sensitive areas, such as sinkholes, wells, gullies, ditches, soils with high water tables near streams, surface inlets or rapidly permeable soil areas.

Consider the potential problems from odors associated with the land application of animal manures, especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with the land application of animal manures. Volatilization losses can become significant, if manure is not immediately incorporated into the soil after application.

Consider the potential to affect National Register listed or eligible cultural resources.

Consider using soil test information no older than one year when developing new plans, particularly if animal manures are to be a nutrient source.

Consider annual reviews to determine if

changes in the nutrient budget are desirable (or needed) for the next planned crop.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN), "end of season" corn stalk testing or soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

### PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

The following components shall be included in the nutrient management plan:

- ◆ aerial photograph or map and a soil map of the site with soil interpretations,
- ◆ current and/or planned plant production sequence or crop rotation,
- ◆ results of soil, plant, water, manure or organic by-product sample analyses,
- ◆ realistic yield goals for the crops in the rotation,
- ◆ quantification of all nutrient sources,
- ◆ recommended nutrient rates, timing, form, and method of application and incorporation,
- ◆ location of designated sensitive areas or resources and the associated, nutrient management restriction,
- ◆ guidance for implementation, operation, maintenance, record keeping, and
- ◆ complete nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.

If increases in soil phosphorus levels are expected, plans shall document:

- ◆ the soil phosphorus levels at which it may be desirable to convert to phosphorus based implementation,
- ◆ the relationship between soil phosphorus levels and potential for phosphorus transport from the field, and
- ◆ the potential for soil phosphorus drawdown from the production and harvesting of crops.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

In addition to the requirements described above, plans for nutrient management shall also include:

- ◆ discussion about the relationship between nitrogen and phosphorus transport and water quality impairment. The discussion about nitrogen should include information about nitrogen leaching into shallow ground water and potential health impacts. The discussion about phosphorus should include information about phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.
- ◆ discussion about how the plan is intended to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairment.
- ◆ a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan.

### OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and

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maintenance addresses the following:

- ◆ periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
- ◆ protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- ◆ calibration of application equipment to ensure uniform distribution of material at planned rates.
- ◆ documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
- ◆ Maintaining records to document plan implementation. As applicable, records include:
  - soil test results and recommendations for nutrient application,
  - quantities, analyses and sources of nutrients applied,
  - dates and method of nutrient applications,
  - crops planted, planting and harvest dates, yields, and crop residues removed,
  - results of water, plant, and organic by-product analyses, and
  - dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state, or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by the cleaning nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.